CLAIMS

1. A system (1) for collecting biological information on a dyed biological particle by irradiating light onto liquid containing the dyed biological particles and detecting information light therefrom, the system comprising:

a path-defining structure (2) of transparent material defining a flow path (3) through which the liquid containing the dyed biological particles runs;

an irradiation apparatus (5) for irradiating light onto the particles passing through the flow path (3);

a first detecting apparatus (21) for detecting first information light obtained from the irradiated particle; and

a second detecting apparatus (25) for detecting second information light obtained from the irradiated particle;

wherein at least one of said first and second detecting apparatuses (21, 25) includes one or more fiber optics (26, 27), of which one ends (61, 62) are arranged adjacent the flow path (3) so as to collect the information light.

2. The system according to Claim 1,

wherein the flow path defined by said path-defining structure (2) has a rectangular cross section defined by a

pair of first walls (57, 58) and a pair of second walls (55, 56) perpendicular to the first walls (57, 58);

wherein said irradiation apparatus (5) emits light to one of the first walls (57, 58);

wherein said first detecting apparatus (21) detects light transmitting through another one of the first walls (57, 58); and

wherein said second detecting apparatus (25) detects light transmitting through one of the second walls (55, 56).

3. The system according to Claim 2,

wherein one ends (61, 62) of the fiber optics (26, 27) are arranged substantially in parallel to one of the second walls (55, 56).

4. The system according to Claim 2 or 3,

wherein said path-defining structure (2) includes a partition plate (78) between one ends (61, 62) of the fiber optics (26, 27) and one of the walls (56) opposing to one ends (61, 62) of the fiber optics (26, 27); and

wherein one ends (61, 62) of the fiber optics (26, 27) opposes to the partition plate (78).

5. The system according to Claim 4,

wherein a gap between one ends (61, 62) of the fiber

optics (26, 27) and the partition plate (78) is filled up with transparent filler material (86).

6. The system according to Claim 4,

wherein a gap between one ends (61, 62) of the fiber optics (26, 27) and the partition plate (78) is filled up with transparent filler material (86) having refraction index that is substantially intermediate between ones of the fiber optics and the partition plate (78).

7. The system according to Claim 2,

wherein the flow path (3) having the rectangular cross section is designed such that light diffused and scattered at the corner portions (64-67) formed at intersections of the first walls (57, 58) and the second walls (55, 56) are prevented from entering into fiber optics (26, 27).

8. A system (1) for collecting biological information on a dyed biological particle by irradiating light onto liquid containing the dyed biological particles and detecting information light therefrom, the system comprising:

a path-defining structure (2) of transparent material for defining a flow path (3) through which liquid containing the dyed biological particles runs;

an irradiation apparatus (5) for irradiating light

onto the particles passing through the flow path (3);

a first detecting apparatus (21) for detecting first information light obtained from the irradiated particle; and

a second detecting apparatus (25) for detecting second information light obtained from the irradiated particle;

wherein said irradiation apparatus (5) includes first optical elements (6, 9, 10, 11) for collecting light at a first position (151) and second optical elements (7, 13, 14, 15, 16) for collecting light at a second position (152), the first and second positions (151, 152) being spaced from each other by a predetermined distance along a central axis of the flow path (3);

wherein at least one of said first and second detecting apparatuses (21, 25) includes first and second fiber optics (26, 27), of which one ends (61, 62) are arranged adjacent the flow path (3) so as to collect the information light from the particles irradiated at the first and second positions (151, 152).

9. The system according to Claim 8,

wherein the first and second positions (151, 152) are determined such that the emitted/scattered light from the particle at the first position (151) is prevented from entering into the second fiber optics (27), and the

scattered light from the particle at the second position (152) is prevented from entering into the first fiber optics (26).

10. The system according to Claim 8 or 9,

wherein a fiber bundle is formed by a central fiber optics and six fiber optics that are closely arranged around the central fiber optics; and

wherein two of the fiber optics of the fiber bundle are selectively used as the first and second fiber optics (26, 27).

11. The system according to any one of Claims 1-10, said path-defining structure (2) including:

a first transparent member (75) having at least one planar surface (76);

a second transparent member (78) having a pair of opposing planar surfaces in parallel to each other, one of the surfaces opposing to the first transparent member (75) and being spaced from the first transparent member (75) by a predetermined distance; and

a pair of third transparent members (77) sandwiched between the planar surface (76) of the first transparent member (75) and one of the surfaces opposing to the first transparent member (75), the pair of the third transparent

members (77) being spaced from each other by a predetermined distance, so as to define the rectangular flow path (3) in conjunction with the first and second transparent members (75, 78).

12. The system according to Claim 11,

wherein said path-defining structure (2) further includes a fourth member (79) opposing to another one of the surfaces of the second member (78), for holding a fiber block (81) therein, which supports one ends of the first and second fiber optics (26, 27).

13. The system according to any one of Claims 1-12,

wherein at least one of said first and second detecting apparatuses (21, 25) includes a fiber connector (28, 29) at another end of the first and second fiber optics (26, 27); and

wherein a collimating lens (32, 33) is provided within the fiber optics (26, 27) for collimating light that has been transmitted through the fiber optics (26, 27).

14. The system according to any one of Claims 1-13,

wherein at least one of said first and second detecting apparatus (21, 26) includes a spectrometer (30, 31) for splitting light components from light received by

the fiber optics (26, 27), and a plurality of optical detectors (35, 37) for reading information within the light split by the spectrometer (30, 31).

15. The system according to Claim 14, further including a signal processing apparatus (24), said signal processing apparatus (24), including:

an A/W/H circuitry (103) for calculating an area, width, and height of a plurality of analog signals output from a plurality of the optical detectors (35, 37);

an A/D converter (104) for converting analog signals output from the A/W/H circuitry into digital signals;

a first-in first-out memory (105) for storing digital information based upon digital signals output the A/D converter (104) and for simultaneously outputting a plurality of digital information;

a compensation circuitry (107) for compensating digital signals output from the memory (105); and

a logarithmic calculator (108) for logarithmically calculating digital information output from the compensation circuitry (107).

16. The system according to any one of Claims 1-15, further including:

a cylindrical container (40) having a laminar-flow

generating chamber (44) provided upstream the flow path (3);

a sheath-fluid line (46) for supplying sheath fluid constituting a main body of the liquid from an upper end of the cylindrical container (40);

a suspension-fluid tube (49) arranged along the central axis of the cylindrical container (40) for supplying suspension fluid containing the particles into the sheath fluid running within the laminar-flow generating chamber (44);

a mechanism (51) for adjusting a position of a suspension-fluid outlet (50) of the suspension-fluid tube (49).

17. The system according to any one of Claims 1-16, further including:

a drain line (97) connected with a lower end of the laminar-flow generating chamber (44);

a sheath-fluid source (45) of the sheath fluid;

a sheath-fluid waste (99) of the sheath fluid;

means for selectively connecting the drain line (97) with either one of the sheath-fluid source (45) and the sheath-fluid waste (99).

18. The system according to any one of Claims 1-17,

further including:

means (90) for imparting oscillation on the liquid in a direction perpendicular to the fluid flow.

19. The system according to any one of Claims 1-17, further including:

means (90) for imparting oscillation on the liquid in a direction along the fluid flow.

20. The system according to any one of Claims 1-19, further including:

charging means (93) for charging a droplet injected from the flow path;

a pair of deflecting plates (94a, 95a) provided adjacent a dropping path of the charged droplet; and

a power source circuitry (92) for generating an electrical field between a pair of the deflecting plates (94a, 95a);

wherein at least one of the deflecting plates (94a, 95a) is formed from a porous plate, and an aspirator (94b, 95b) being provided at rear end of the porous deflecting plate for aspirating droplet attached on the porous deflecting plate.